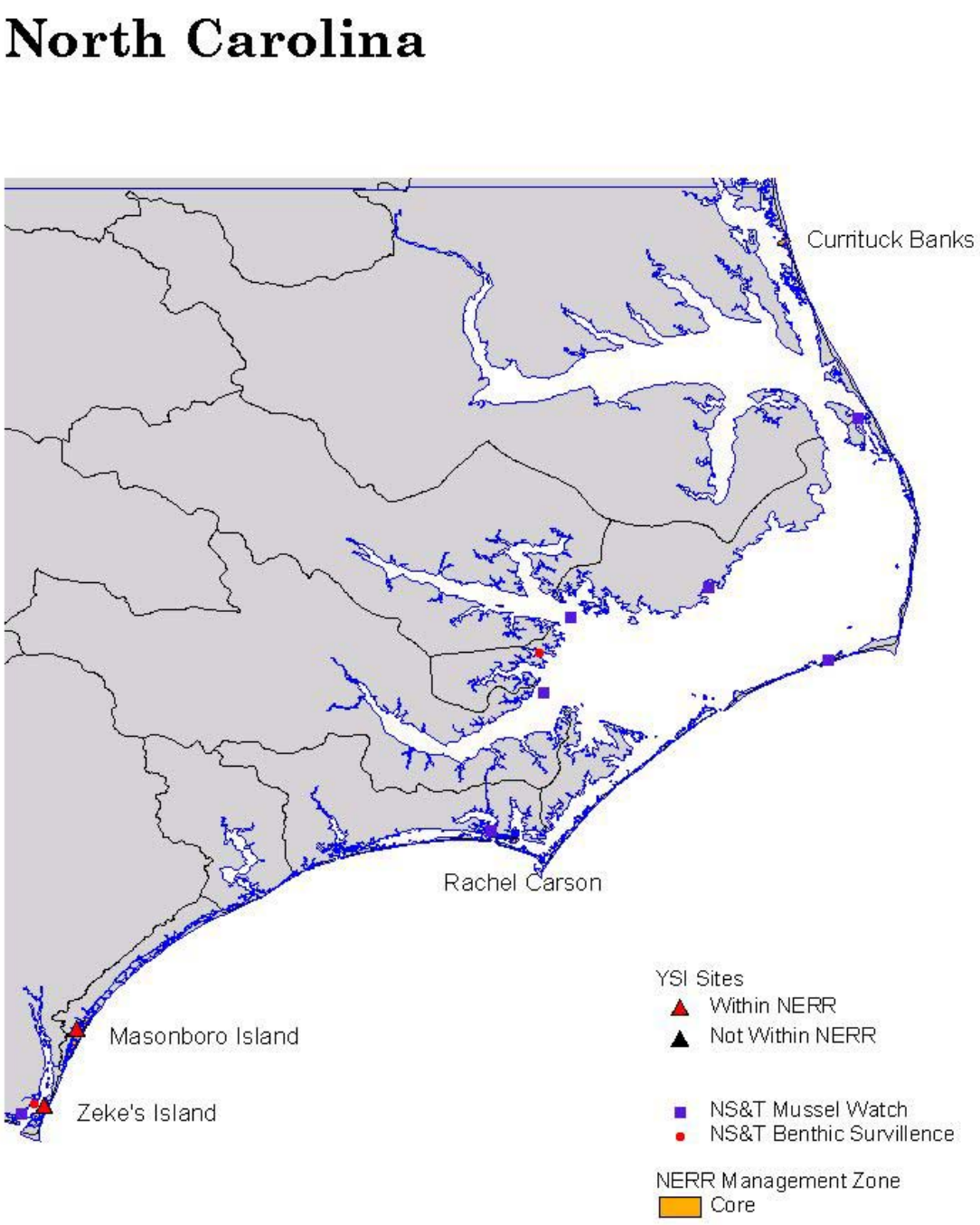
Figure 138. Net metabolism at Thousand Acre Creek, 1996-1998.



North Carolina, Masonboro Island (NOCMS)

Characterization (Latitude = 34° 09' 22"N; Longitude = 77° 51' 00"W)
Tides at Masonboro Island are semidiurnal. The Masonboro Island site is 0.72 km northeast from the mouth of Whiskey Creek, and east of the Intracoastal Waterway, in a small navigable channel called Research Creek. Research Creek connects the Intracoastal Waterway with a diffuse bay and marsh system west of Masonboro Island. Research Creek has an average depth of 1.0 m MHW (mean range = 0.75-1.5 m) and an average width of 20 m. At the sampling site, the depth is around 2.25 m MHW and the width is about 20 m. Creek bottom habitats are predominantly fine silt, sand and shell, with no bottom vegetation except for seasonal benthic algae. The dominant marsh vegetation near the sampling site is *Spartina* sp. Upland areas are dredge spoil islands with mixed bushes and small pine trees. Activities that potentially impact the site include recreational uses (fishing, jet skis, boating), dredging and dredge spoil deposition, and development. This site is relatively un-impacted by manmade perturbations.

Descriptive Statistics
Sixty-eight deployments were made at this site between Jan 1996 and Dec 1998, with equal coverage during all seasons (Figure 139). Mean deployment duration was 14.7 days. Only three deployments (Jan, Jul 1996 and Jan 1998) were less than five days.

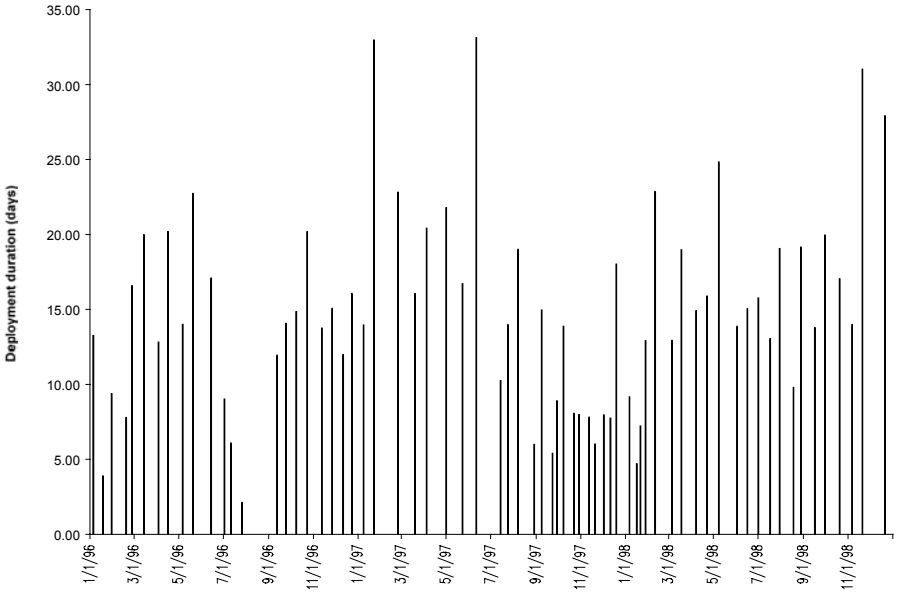


Figure 139. North Carolina NERR, Masonboro Island deployments (1996-1998).

Eighty-five percent of annual depth data were included in analyses (87% in 1996, 78% in 1997, and 91% in 1998). Sensors were deployed at a mean depth of 1.3 m below the water surface and about 0.1 m above the bottom sediment. Scatter plots suggest strong fluctuations (1-2 m) in depth during daily and bi-weekly intervals, with consistent amplitude throughout the data set. Harmonic regression analysis attributed 87% of depth variance to 12.42 hour cycles, 6% of depth variance to 24 hour cycles, and 7% of depth variance to interaction between 12.42 hour and 24 hour cycles.
Eighty-seven percent of annual water temperature data were included in analyses (87% in 1996, 83%

in 1997, and 91% in 1998). Water temperature followed a seasonal cycle, with mean water temperatures 10-12°C in winter (1997, 1998) and 25-28°C in summer (Figure 140). Mean water temperature in winter 1996 was slightly lower (8-11°C) than in winter 1997 and 1998. Minimum and maximum water temperatures between 1996-1998 were -0.4°C (Jan 1996) and 34.6°C (Jul 1998), respectively. Scatter plots suggest strong fluctuations (1-7°C) in daily water temperature and stronger fluctuations (3-15°C) in bi-weekly water temperatures, with strongest fluctuations in spring and fall. Harmonic regression analysis attributed 60% of temperature variance to interaction between 12.42 hour and 24 hour cycles, 25% of variance to 24 hour cycles, 15% of variance to 12.42 hour cycles.

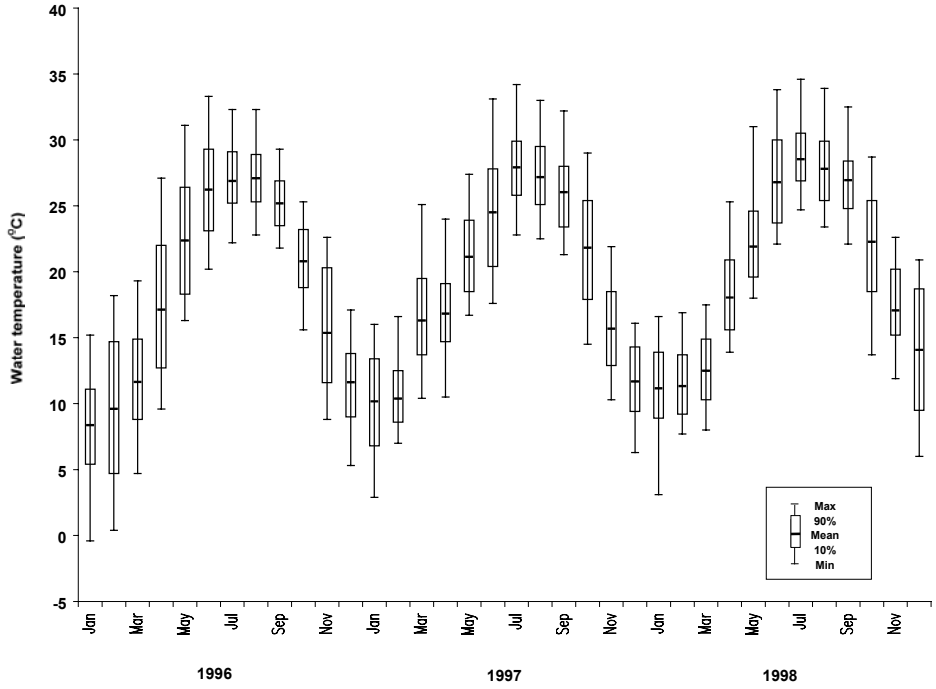


Figure 140. Water temperature statistics for Masonboro Island, 1996-1998.

Eighty-four percent of annual salinity data were included in analyses (86% in 1996, 80% in 1997, and 87% in 1998). Mean salinity throughout 1996 and 1997 (27-31 ppt) was greater than mean salinity in 1998 (23-29 ppt); however, large variances (10-15 ppt) were associated with mean salinity throughout the data set (Figure 141). Minimum and maximum salinity between 1996-1998 were 7.8 ppt (Sep 1998) and 37.2 ppt (Aug 1997), respectively. Scatter plots suggest strong fluctuations in daily and bi-weekly intervals equivalent to, or in excess of, annual variation in mean salinity. Harmonic regression analysis attributed 73% of salinity to 12.42 hour cycles, 17% of salinity variance to interaction between 12.42 hour and 24 hour cycles, and 10% of salinity variance to 24 hour cycles.

Seventy-one percent of annual dissolved oxygen (% saturation) data were included in analyses (79% in 1996, 58% in 1997, and 75% in 1998). Mean DO was typically 75-110% saturation. Mean DO below 50% saturation and above 120% saturation was never observed. Minimum and maximum DO between 1996-1998 was 2.4% saturation (Apr, May 1998) and 264.8% (Apr 1996), respectively. Hypoxia was observed in Apr 1998 and persisted for 1% of the first 48 hours post deployment (Figure 142). Supersaturation was regularly observed in 1996 and 1997, but less frequently observed in 1998.

When present, supersaturation persisted for 17% of the first 48 hours post-deployment on average. Scatter plots suggest moderate (20-60%) fluctuations in daily and bi-weekly percent saturation throughout most of the data set, with strong fluctuations (≥80%) observed during episodic events in spring in all years. Harmonic regression analysis attributed 63% of DO variance to interaction between 12.42 hour and 24 hour cycles, 29% of DO variance to 24 hour cycles, and 8% of DO variance to 12.42 hour cycles.

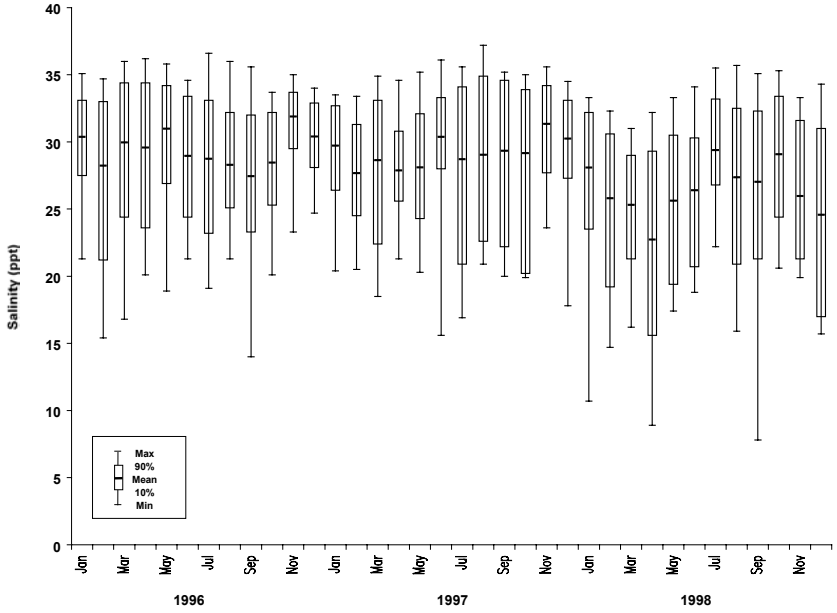


Figure 141. Salinity statistics at Masonboro Island, 1996-1998.

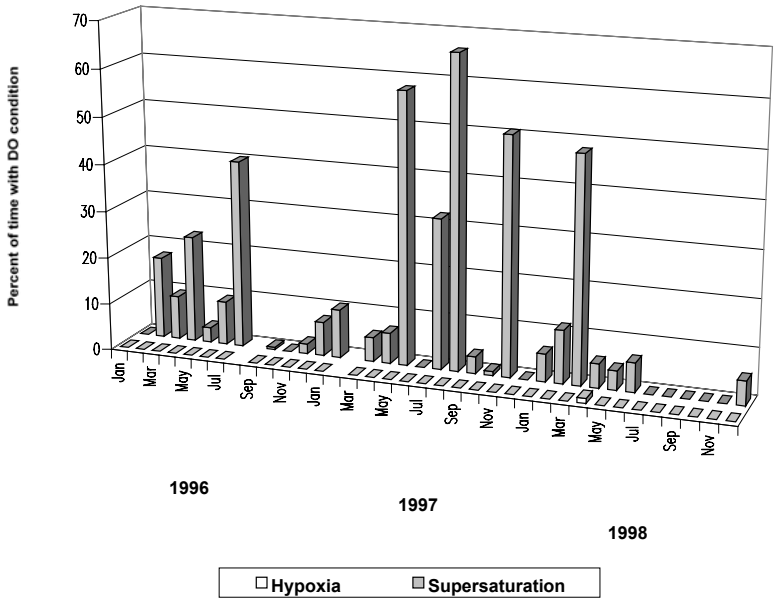


Figure 142. Dissolved oxygen extremes at Masonboro Island, 1996-1998.

North Carolina, Zeke's Island (NOCZI)

Characterization (Latitude = 33°56'24"N; Longitude = 77°56'28"W)
Tides at Zeke's Island are semidiurnal, with an average tidal range of 1.2-1.4 m. Zeke's Island Component is near the mouth of the Cape Fear River, east of the Intracoastal Waterway. The sampling site is at the East Crib of Zeke's Island which is located 1.8 km south of Federal Point boat launch in a tidal basin estuary and north of the New Inlet, which connects the estuary with the Atlantic Ocean. The East Crib is composed of rocks stabilizing a channel connecting the inner and outer basins of the Zeke's Island Component. The sampling site is at the confluence of several tidal channels with water depths between 0.5-2.0 m MHW. Creek bottom habitats are primarily sand with no bottom vegetation except for seasonal algae. Current flow through the area where the meter is placed can be fairly high. The dominant marsh vegetation near the sampling site is *Spartina* sp. The dominant upland vegetation includes scattered bushes (bay, myrtle, etc.) and pine trees. Most of the surrounding land is either in the Reserve or part of a state park system; therefore, the land use around this site is mostly recreational (fishing, jet skis, boating). This site is relatively un-impacted by manmade perturbations.

Descriptive Statistics
Sixty-four deployments were made at this site between Jan 1996 and Dec 1998, with equal coverage during all seasons (Figure 143). Mean deployment duration was 16.6 days. Only one deployment (Dec 1997) was less than five days

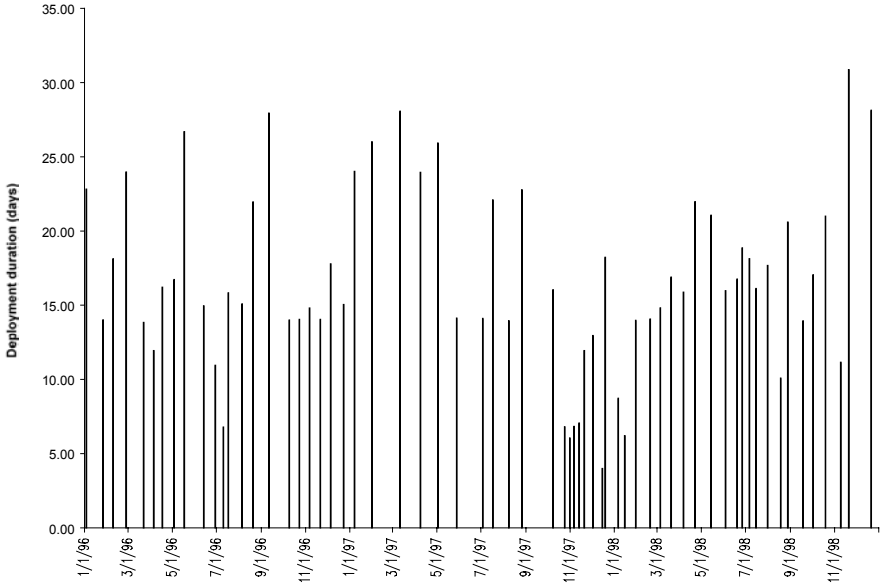


Figure 143. North Carolina NERR, Zeke's Island deployments (1996-1998).

Eighty-eight percent of annual depth data were included in analyses (94% in 1996, 79% in 1997, and 91% in 1998). Sensors were deployed at a mean depth of 1.5 m below the water surface and 0.1 m above the bottom sediment, except for Feb and Jun 1997 (mean depth ≤ 0.5 m below sea level). Scatter plots suggest strong fluctuations (≥ 2 m) in daily and bi-weekly water depth. Harmonic regression analysis attributed 89% of depth variance to 12.42 hour cycles, 5% of depth variance to 24 hour cycles, and 6% of depth variance to interaction between 12.42 hour and 24 hour cycles.
Eighty-eight percent of annual water temperature data were included in analyses (94% in 1996, 79% in 1997, and 91% in 1998). Water temperature followed a seasonal cycle, with mean water temperatures

10-11°C in winter (1997, 1998) and 25-28°C in summer (Figure 144). Mean water temperature in winter 1996 was more variable (8-13°C) than winter 1997-1998. Minimum and maximum water temperatures between 1996-1998 were -0.3°C (Jan 1996) and 33.1°C (Jul 1997), respectively. Scatter plots suggest strong fluctuations (≤ 5°C) in daily water temperature and even stronger fluctuations (5-10°C) in bi-weekly water temperatures in all seasons, particularly winter and fall. Harmonic regression analysis attributed 76% of temperature variance to 24 hour cycles, 18% of temperature variance to interaction between 12.42 hour and 24 hour cycles, and 6% of temperature variance to 12.42 hour cycles.

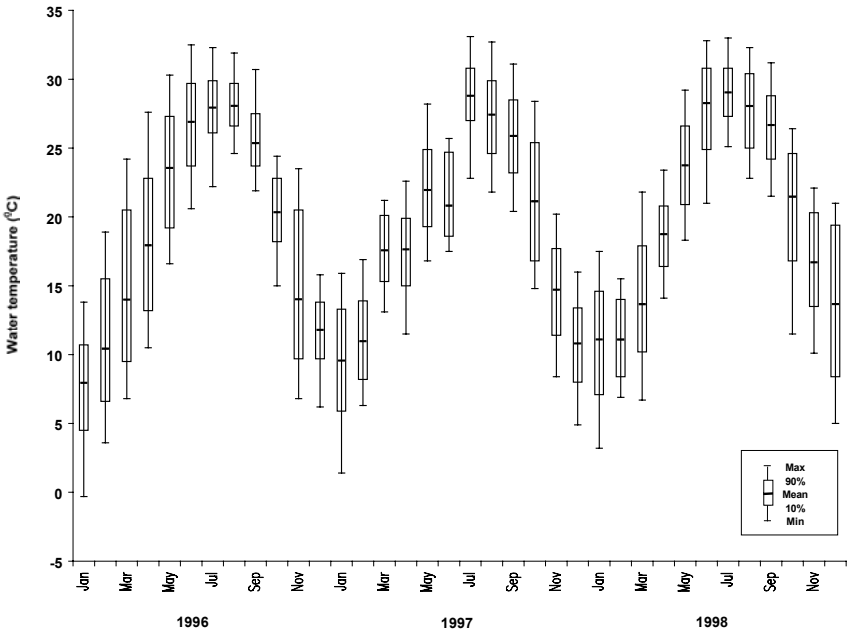


Figure 144. Water temperature statistics for Zeke's Island, 1996-1998.

Eighty-five percent of annual salinity data were included in analyses (89% in 1996, 79% in 1997, and 87% in 1998). Mean salinity followed a seasonal cycle, with lowest salinity in winter and greatest salinity in summer for 1997 and 1998 (Figure 145). Mean salinity in 1996 was 21-26 ppt throughout the year, but dropped abruptly (11-12 ppt) in Sep-Oct. Abrupt drop in salinity in Sep-Oct 1996 was likely due to Hurricane Fran which dumped excessive amounts of freshwater into inland tributaries and altered salinity for several weeks. Mean salinity was lowest in winter 1998 (5-7 ppt), which was also likely related to large freshwater input during this El Nino year. Minimum and maximum salinity between 1996-1998 was 1.6 ppt (Feb 1998) and 35.4 (Aug 1998), respectively. Scatter plots suggest strong fluctuations (5-10 ppt) in salinity throughout the data set, with extremely strong (15-25 ppt) fluctuations observed during episodic storm events in Sep 1996, May 1997, and Sep 1998. Harmonic regression analysis attributed 60% of salinity variance to 12.42 hour cycles, 26% of salinity variance to interaction between 12.42 hour and 24 hour cycles, and 14% of salinity variance to 24 hour cycles.

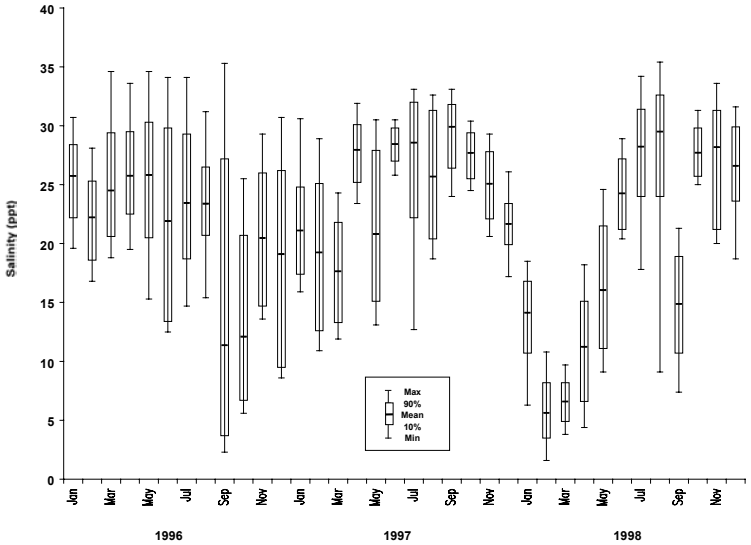


Figure 145. Salinity statistics for Zeke's Island, 1996-1998.

Seventy-three percent of annual dissolved oxygen data (% saturation) were included in analyses (79% in 1997, 66% in 1997, and 73% in 1998). Mean dissolved oxygen was 60-110% saturation throughout the data set. Minimum and maximum DO between 1996-1998 was 4.3% saturation (Jun 1996) and 232.9% saturation (Apr 1997), respectively. Hypoxia was observed in Jun 1998 and persisted for 17.7% of the first 48 hours post-deployment (Figure 146). Supersaturation was observed regularly in 1996 and 1997 and, when present, supersaturation persisted for 15% of the first 48 hours post-deployment on average. Moderate fluctuations (20-60%) in daily and bi-weekly percent saturation were observed throughout most of the data set; however, strong fluctuations (≥ 100%) were observed during episodic events in Jun 1996 and Jul, Sep 1998. Harmonic regression analysis attributed 60% of DO variance to 24 hour cycles, 18% of DO variance to 12.42 hour cycles, and 22% of DO variance to interaction between 12.42 hour and 24 hour cycles.

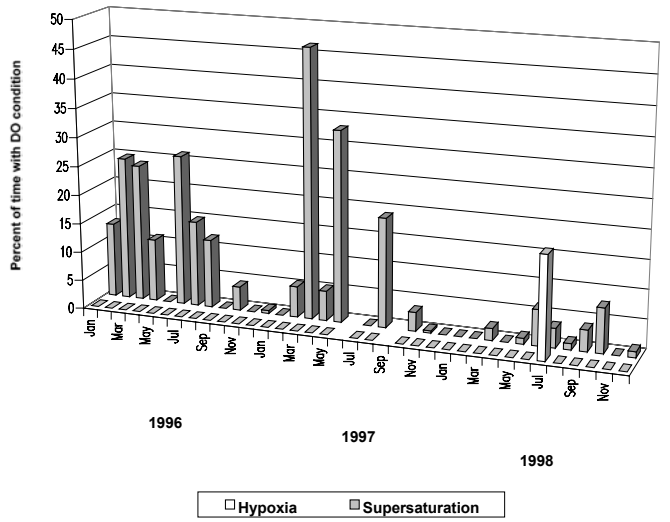


Figure 146. Dissolved oxygen extremes at Zeke's Island, 1996-1998.